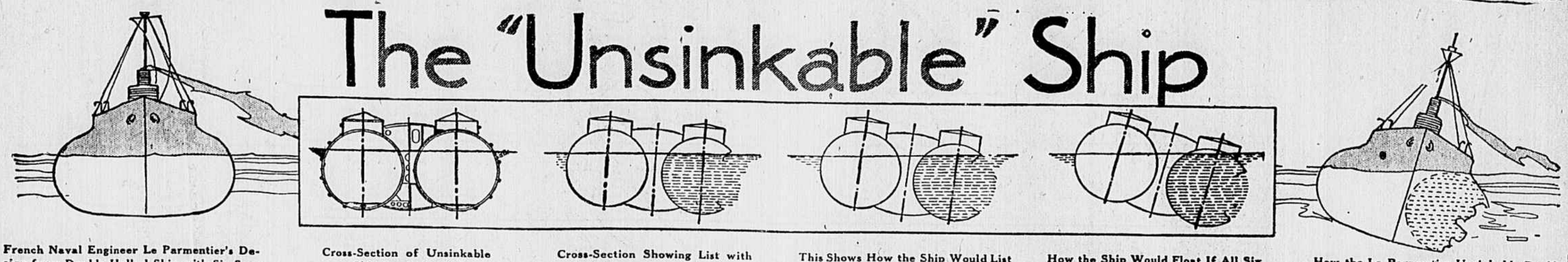
The "Unsinkable" Ship



French Naval Engineer Le Parmentier's Design for a Double-Hulled Ship with Six Separate Compartments in Each of the Two Parallel Hulls.

Cross-Section of Unsinkable Ship Loaded with Freight.

Cross-Section Showing List with Two Compartments in One Hull Flooded.

This Shows How the Ship Would List If Four of the Compartments on One Side Were Flooded with Water

How the Ship Would Float If All Six Compartments in One of the Hulls Should Be Flooded with Water.

How the Le Parmentier Unsinkable Double-Hulled Ship Would Continue to Float and Be Able to Pursue Her Journey Even If a Torpedo Had Torn Open All of the Six Compartments in One of the Double Hulls.

(From Diagrams Printed in the Scientific American.)

How the U-Boat Menace Has Stimulated Inventors to Design Steamships Which Are Almost Impossible to Sink

STRICTLY speaking, no ocean steamship can be "unsinkable." A reef of rocks and the hammering of wind and sea could pound to pieces anything which the ingenuity of man could construct.

But the menace of the submarines has turned the attention of naval designers to the problem of constructing what is practically an unsinkable freighter. French, Italian and American experts have each evolved a model which their respective Governments have adopted as worth a trial.

At the top of this page are diagrams showing the design of M. Le Parmentier, a distinguished French naval engineer. This unsinkable ship has really two separate hulls, joined together with the superstructures. These two separate parallel hulls each have six watertight compartments. Extensive experiments have shown that a torpedo might crash through every one of the six watertight compartments on one side of the ship and yet the ship would float with all six of these compartments filled with water. But to accomplish this it would be necessary to explode not less than three torpedoes against one side of one hull, each torpedo striking in such a position as to penetrate two compartments.

It has been demonstrated that even if such a thing happened the ship would still float at no very uncomfortable angle, and would be able to continue her way without damage to her engine room.

A New York Shipbuilding company is already at work upon the construction and equipment of five or six of these new steel cargo steamers for the French Government.

The United States Government has approved a design for an unsinkable ship which was worked out by Mr. Hudson Maxim, the famous inventor of smokeless powder and one of the leading world experts on high explosives. Mr. Maxim's ship is protected by a water-tight jacket which may be filled with fuel oil or with water. This structure is the water or oil barrier which is relied upon to save the ship from sinking in case it is penetrated by a torpedo or jagged rock.

Mr. Maxim has described his new invention in an article in Popular Science. A series of vertical steel cylinders are provided for carrying pulverized coal, and these cylinders are placed just inside the liquid barrier, connected with and forming an integral part of it. Through the centre of the cylinders is run a screen of steel rods welded to the walls of the cylinders.

In his descriptive article Mr. Maxim points out that the warhead of a German torpedo carries about 400 pounds of a very high explosive. When a ship is struck by a torpedo deep in the water there is a striking force of about 300,000 pounds per square inch. The pressure exerted by such an enormous blow is so great that often a ship is broken in two. What is wanted, Mr. Maxim explains, is a shock absorber.

"I find," writes Mr. Maxim in Popular Science, "that pulverized coal, on account of its compressability and elasticity, is a very effectual shock absorber. As pulverized coal may be used for driving the ship, I have chosen it as the main shock absorber. The idea has been offered to the United States Government free of charge during the war.

'When a torpedo strikes a ship constructed according to my plan the hot, rapidly expanding gases first encounter a barrier of water or oil in the hull, then a stout screen of round steel rods, and lastly a series of vertical steel cylinders in which powdered coal is carried. Since it is essential that the gases should be allowed to expand without bursting the ship's compartments, I provide free upward vents through the ship's deck.

"If such a ship should be struck by a torpedo the water or oil of the barrier in the path of the blast will be driven forward through the steel screen, commingling its spray with the hot gases, with the result that the heat of the gases will be instantly absorbed by the spray and their volume reduced. It is safe to assume, I think, that the volume of gases will be reduced at least three-quarters.

"The result of the explosion of a torpedo-warhead against this structure will be to smash a hole through the hull wall, carrying forward a large mass of the water or oil of the barrier and hurling the liquid upon and through the first steel screen, bending the screen somewhat.

The outer wall of the powdered coal cylinders in the path of the blast will be disrupted, and the liquid spray and powdered coal will be carried along together and hurled against the strong screen centrally located in the cylinders; the gases of the explosion and liquid spray and the pulverized coal will be commingled.

"Although even this strong steel screen should yield or bend somewhat under the blast, it will not be entirely carried away or broken through.

"By that time the gases will be vented upward through the top of the cylinders into the atmosphere; the energy of the blast will be so absorbed and dissipated that the inboard wall of the cylinders—that is to say, the bulkhead constituted by the inner wall of the cylinders—will be entirely uninjured and cannot be broken through. Consequently, the only amount of water that can enter the ship will be that which will fill the space between the transverse bulkheads and the inner wall of the cylinders.

"The use of pulverized coal on shore has long passed the experimental stage, and it is admirably adapted to use on board ship. It will save 20 per cent of the coal consumption, besides producing no smoke. Means have already been developed and perfected by which pulverized coal may be piped from the cylinders to any portion of the ship by air pressure as freely and effectually as oil is piped."

The Italian Government has adopted a design worked out by Naval Constructor Umberto Pugliese, which differs radically from the design of the French naval engineer, Le Parmentier, and from Mr. Maxim's design.

The Pugliese unsinkable freighter has a swelling under water on each side of the ship. In this outer hull is carried the coarser cargoes, like coal, ore, grain, salt, etc. If the torpedo strikes and explodes against or into this outer shell of the vessel the force of the explosion is taken up without damage to the inner hull of the ship, which is protected by strong watertight bulkheads.

Describing this invention, the Scientific American says:

"If the torpedo be adjusted to run nearer the surface—say at a depth of five feet—its explosive violence would be greatly sapped by the shallower stratum of water lying above the weapon. In other words, the tamping effect of the superposed water would be cut down nearly two-thirds, and the destructive gases would find a correspondingly easier path of dissipation upward instead of horizontally and inward upon the body of the ship.

"Engineer Pugliese counts upon the character of the bulk cargo to absorb the shock and to lower rapidly the temperature of the rending gases, and then by suitable vents through the two decks above to open further channels of escape. It will be noticed that there is no double bottom under the outboard cargo compartments at the points where mines would be most likely to hit. The freight stowed there would, if displaced by the blast, be more freely lifted than disturbed laterally, and upon this assumption the superheated gases would find their line of least resistance upward and through the large deck vents, which, in fact, are designed to serve as loading hatches.

"It will also be observed that the outboard stowage of freight is carried up to the main deck, and this disposition of the bulk cargo provides a potentially effective bulwark against shell attack from the guns of a submarine operating upon the surface. Likewise, the complete athwartships stowage of cargo forward and abaft of the vital area furnishes what is calculated to be a shield against a raking fore-and-aft fire.

"Should, however, either the torpedo or the mine have force enough to spread its destructive work horizontally and athwartships, then the gases will meet a triple defense in the form of three parallel bulkheads, together providing two air spaces having a total width of substantially 53 inches. Inside of this barrier are placed the vitals in the shape of boilers, engines and stores."

It was early in the present year that the first government effort was made to produce an unsinkable ocean freight ship. It was decided to try out plans which had been approved by the Naval Consulting Board, and which had been submitted by Mr. William T. Donnelly.

Mr. Donnelly's scheme did not call for special construction, but was aimed to fit freight ships of all styles and models which had been already built and were plying the ocean. It was not an attempt to build new ships along any new line of construction. The Government picked out a 10,000-ton steam freighter called the Lucia for the experiment.

This ship already had six watertight bulkheads dividing her five cargo compartments, boiler room, engine room and a collision compartment in the forward part of the ship. The scheme was to build an enormous number of little watertight and airtight wooden boxes and scatter them throughout the ship. If enough of these little wooden life preservers were stowed around in the vessel to keep her afloat after an exploded torpedo had let the water into the hull—then, behold, the unsinkable ship had been produced! It seemed to be a sound scheme.

Describing this plan of Mr. Donnelly's, the Scientific American explained the technical figures as follows:

"In her normal condition the Lucia can carry 10,000 tons of coal, but with the boxes installed she carries 8,300 tons. The total hold capacity of the ship is 508,000 cubic feet when she is provided with a sufficient number of flotation units to protect her against sinking. Of this 152,000 cubic feet will be taken up by the flotation units, and the balance of 356,000 cubic feet at 43 cubic feet per ton will be occupied by the load of 8,300 tons of coal.

"The flotation units are made in three sizes—the smallest is 12 inches deep by 25 inches wide and 3 feet, 1¾ inches long; the next is 18 inches deep by 27 inches wide and 5 feet, 9 inches long; the third, and largest, is 30 inches deep by 30 inches wide by 6 feet, 2 inches long.

"All the boxes are made of ⅞-inch North Carolina pine, and the details of construction are shown clearly in the accompanying sectional perspective view. Two interior transverse bulkheads are provided in each box, and all boxes are covered with galvanized metal to render them watertight. The various units are constructed to withstand pressures corresponding to 10, 20 and 30 feet of water, according to their location in the ship.

The method of stowing the boxes is shown in a perspective view of one of the decks. It will be noticed that they are stowed in between the frames of the hull and between the deck beams on the under side of the decks. The boxes are held in their respective positions by means of battens and threaded bolts, the latter being hooked into the frames and deck beams, and the whole system being brought up snugly into position by means of washers and nuts on the outside of the battens.

"To render a ship unsinkable, three separate conditions are to be considered. First, when she is unloaded; second, when she is loaded with a mixed cargo, and third when she is loaded with a dense, heavy cargo, such as a cargo of coal. For the first condition, reserve buoyancy sufficient to make the ship unsinkable when she is unloaded, is attained by fitting a single layer of flotation units between the frames and deck beams and against the watertight transverse bulkheads. Cargo reserve buoyancy is determined by the nature of the cargo itself and the cubical area occupied.

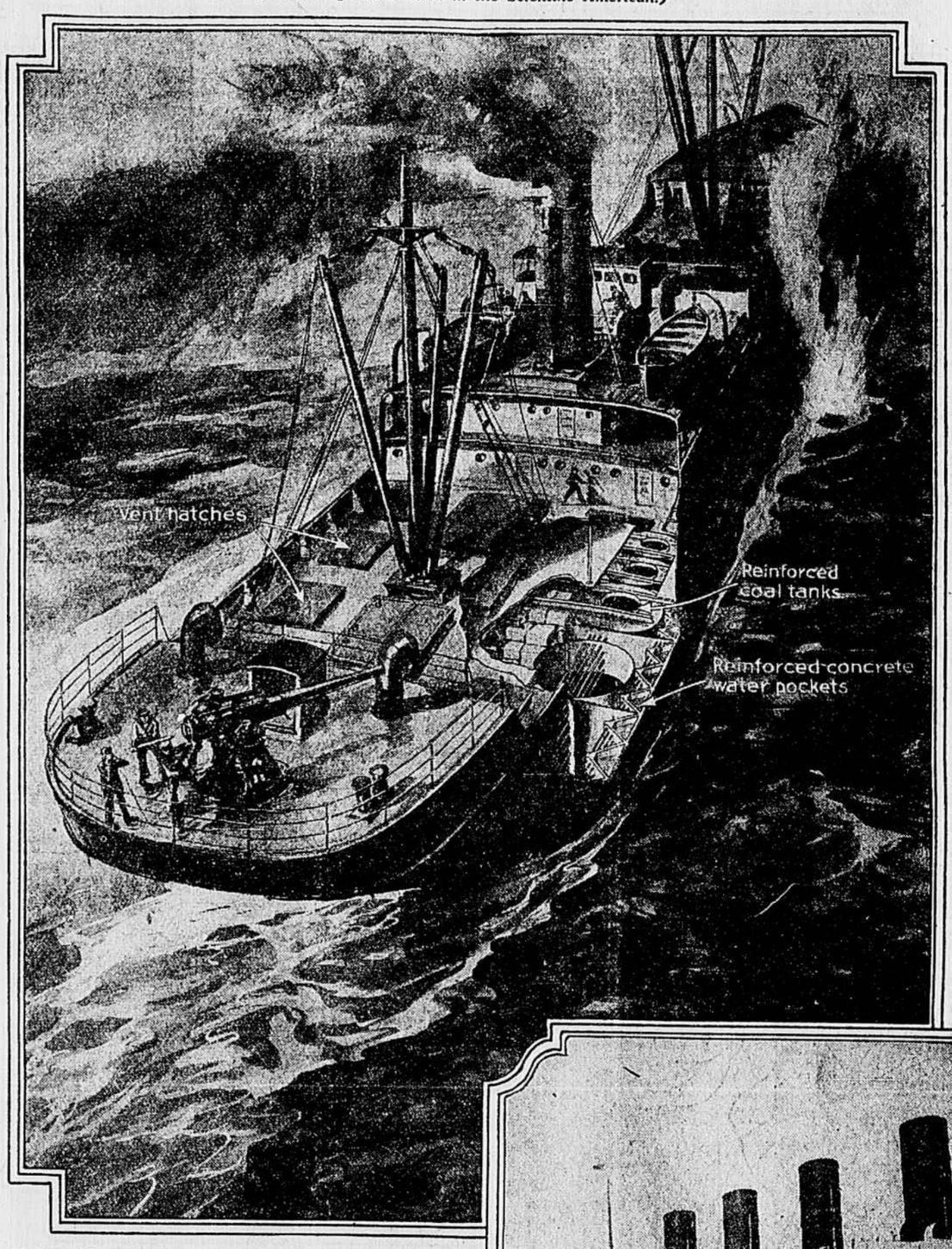
"For instance, in the case of a 5,000-ton ship, 56 cubic feet is allowed per ton, making a total for that ship of about 280,000 cubic feet. The reserve buoyancy units necessary to float the ship when it is unloaded equals about 10 per cent of this tonnage, or 500 tons, leaving a net tonnage of 4,500 tons or 252,000 cubic feet. A coal cargo requires 43 cubic feet of space per ton, which on the net tonnage of 4,500 tons amounts to 193,500 cubic feet.

This is deducted from the total net cubic feet and leaves reserve space of 58,500 cubic feet for reserve buoyancy units to float the dead-weight cargo. It is claimed by the sponsor for this system that the loss of cargo space in a ship that is self-salvaging is more than offset by the salvaging of the cargo and of the ship itself."

The Lucia was finally outfitted with the little watertight life preservers according to Mr. Donnelly's plans, as approved by the United States Naval Consulting Board. The ship was loaded and sent into the submarine zone with great expectations.

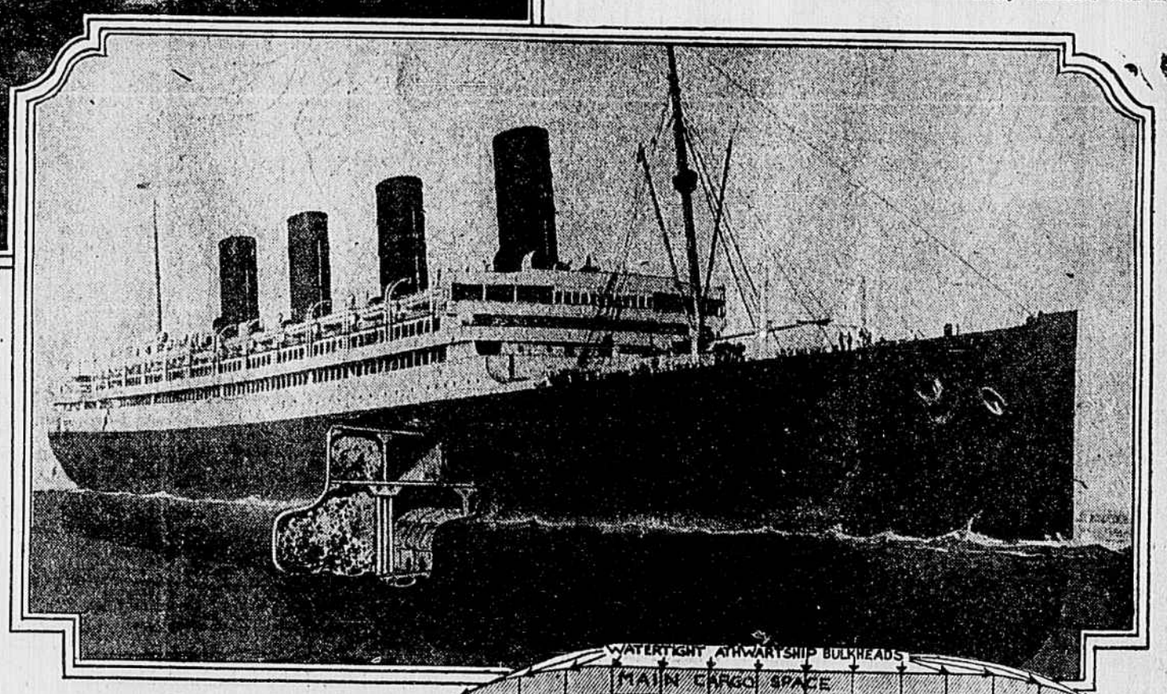
But a brief cablegram of October 19 announces that this unsinkable ship, the Lucia, was torpedoed and sunk! Naval architects and government officials are awaiting with great interest to hear the details of just what happened to the "unsinkable" Lucia to see whether a lesson is to be learned from her disappointing fate. Why did Mr. Donnelly's scheme go wrong?

The war will have conferred at least one blessing if ship builders learn to construct ocean liners that will be reasonably "unsinkable."



Hudson Maxim's Torpedo-Proof Ship, Which the United States Shipping Board Is Now Building. (From Drawing Made for Popular Science Monthly.)

Mr. Hudson Maxim's New Design for a Torpedo Proof Freight Ship Which the United States Shipping Board Is Building.



Unsinkable Cargo Ship Designed by Italian Naval Constructor Pugliese

This Ship Was Constructed with Two Hulls. The Outer Hull Carries the Coarse Bulk Cargoes Like Coal or Wheat. The Inner Hull Carries the More Valuable Freight and Is Enclosed by Waterproof Bulkheads. If the Torpedo Strikes and Explodes in the Outside Cargo the Ship Would Still Float and the Cargo and Machinery in the Inner Hull Would Be Safe.

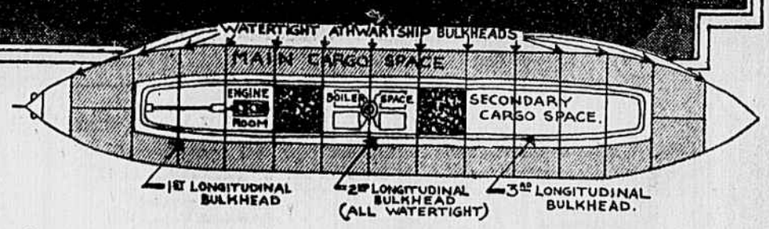


Diagram View of Pugliese's Double-Hulled Unsinkable Ship, Showing Cargo Spaces.